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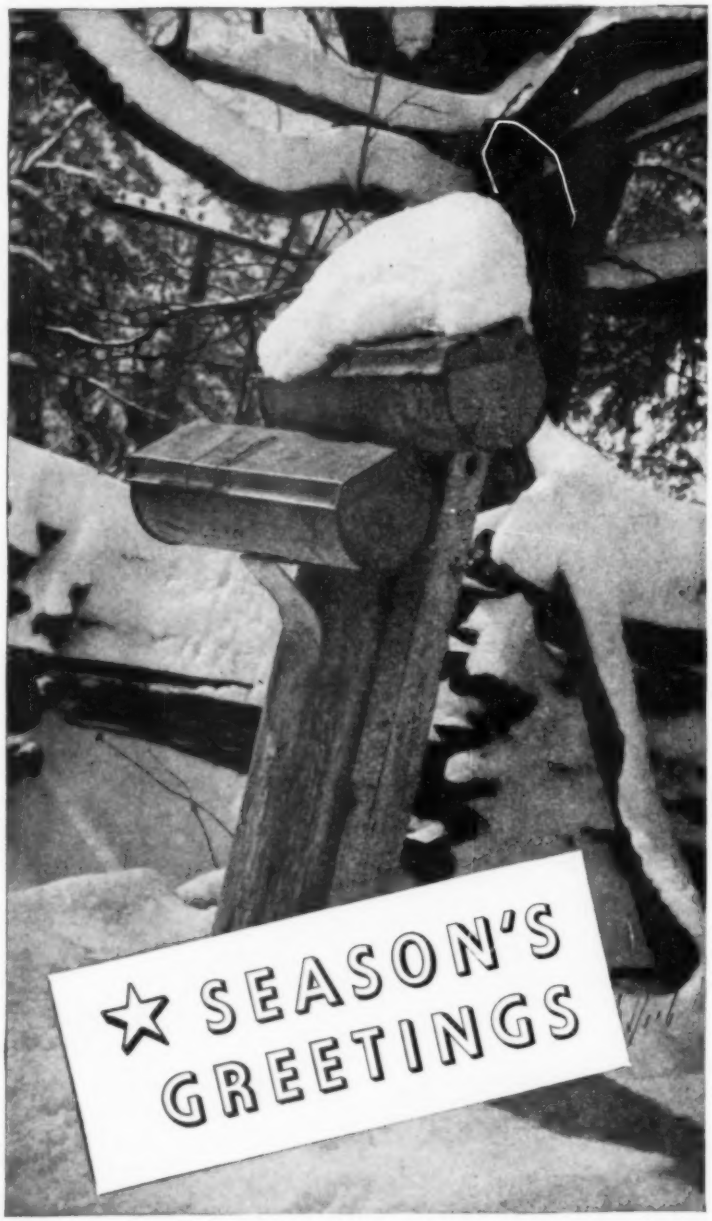

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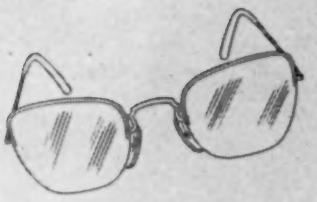

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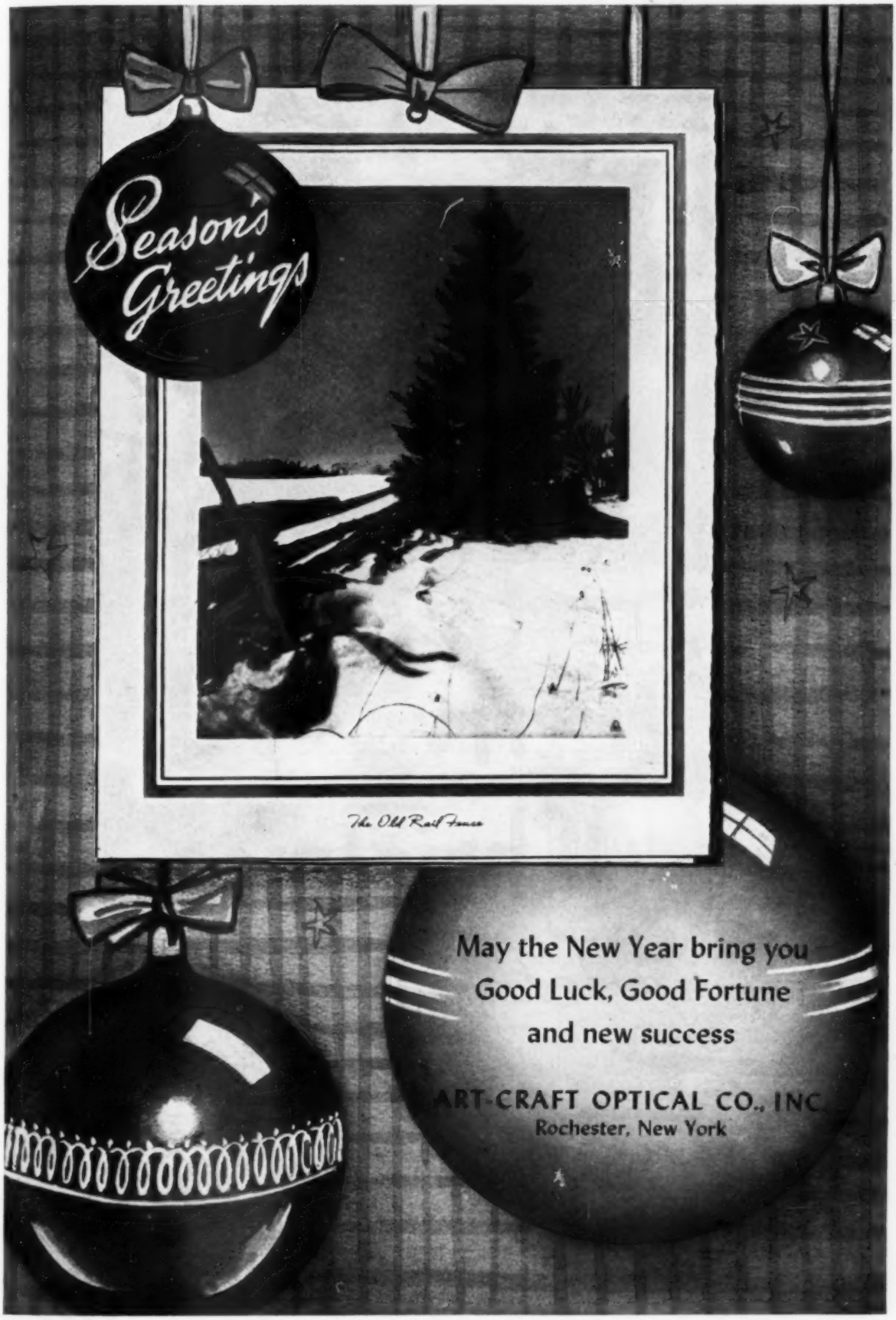
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Vol. 25 DECEMBER, 1948 No. 12

EDUCATIONAL PSYCHOLOGY AS APPLIED TO VISION TRAINING*

Daniel Woolf†
Optometry Laboratory, Columbia University
New York, New York

In this program you have had capable presentation of the methodology of orthoptic training as applied to different conditions. In each case a procedure, fixed or tentative, must be laid out in order that the expected result be attained. Yet success or failure in a given case can depend not only on the procedure but also on how the patient is handled. Incorrect management of a case can result in failure just as readily as incorrect procedure; and as a corollary, proper management can bring about a more rapid or effective result. My thesis here is that application of educational psychology—its experimental data and its theories—will aid in better management of these patients. Doubtlessly, this vast body of knowledge is already applied in your training room, at least to some extent. However, the training of an optometrist inculcates attitudes toward precision of measurement which resemble those of the psychophysicist. This attitude of exactness, if used excessively, and if sensed and followed by the patient, can result in less effective training.

Many optometrists with orthoptic training experience will agree that the results realized are due to a learning process. Vision in general is considered a learned process.[1] If we accept its function as giving the organism information about its environment, then we certainly must conclude that learned association with past experience is necessary. Helmholtz's[2] case of a young man seeing for the first time is illustrative.

The general procedure of orthoptics is to train vision to a given

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*Read before the annual meeting of the American Academy of Optometry, Chicago, Ill., December 16, 1947. For publication in the December, 1948, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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level of performance in one or more visual "skills." This training is an educational or learning process.[3] *The purpose of orthoptic training is the development and retention of higher performance levels in certain visual skills together with transfer of the gain from the training situation to the normal existence. It is hoped but by no means certain that this transfer will result in a diminution of subjective symptoms, such as asthenopia.* Accordingly it follows that what psychology has discovered and thought about the subjects of learning, retention, and transfer of learning, should be valuable to us in our work.

Psychologists have investigated these topics in various ways, and in an attempt to discover the significance of their results, have developed theories to assist them. Some of these theories are so divergent as to appear mutually exclusive. For example, some psychologists feel that learning occurs by insight or grasp of the situation, and others by virtue of trials, errors, and corrections. These divergencies appear even greater than some which affect our own field, so that one must decide on the approach of the worker in evaluating the research. On the other hand their experimental results do not appear as divergent as their verbiage.

Virtually all the "schools" of psychology have investigated learning, but two of the approaches concern us particularly. I have reference to the "trial and error" concepts as exemplified by Thorndike as an associationist, and the insight approach of the Gestalt school, especially that of Wolfgang Koehler.

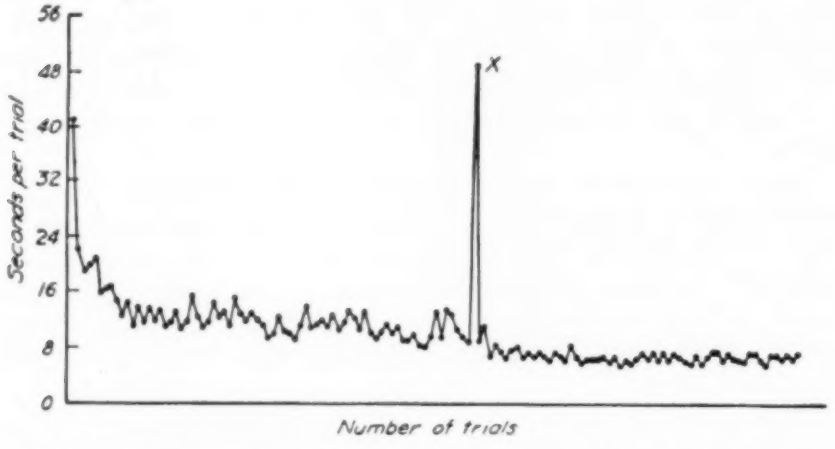

Figure 1. (Data from Ruger, 1910.) Progress of a subject in learning to manipulate a mechanical puzzle. The trials are arranged in order from left to right, the time of each being indicated by the ordinate. Descent of the curve means improvement. At X, the subject studied out a newly observed character of the puzzle, consuming much time in one trial but permanently improving the level of his performance, and also decreasing its variability.

Thorndike[4] studied the behavior of animals in solving the intricacies of puzzle boxes, mazes, and the like. A hungry animal was placed at the start of a maze. Food was placed at the other end, and the time taken by the animal on his run through was recorded. He found that the time gradually reduced, and the number of errors made reduced correspondingly. Finally the maze could be run in a minimum time, with practically no wrong turns. Thorndike could not explain his results on the basis of conditioned reflexes, although he conceived of learning as a process of establishing bonds or connections between the sensory nerves excited by the stimulus and the motor nerves to the reacting muscles.[5] The most often used pathways should become strengthened by use, and the less used connections or associations would be stamped out by disuse. This was termed the law of exercise. But if this were the only principle involved then the incorrect responses would be strengthened by use just as much as those that were of value to the organism. Accordingly he had to introduce what is called the law of effect: that responses or associations which lead to a favorable result are strengthened, those which do not are stamped out. Mechanistically inclined psychologists have tried to eliminate this second law but later work has given it a firmer foundation rather than destroying it.[6] So to summarize the value of Thorndike's work for us, we have:

1) The more a pattern of behavior is exercised the better its development.
2) The more adequate the pattern in reaching a goal or end the better its development, and
3) More by implication than by direct statement, a motive must be provided in order that the learning occur.

Another vital approach to learning is that of the Gestalt psychologists. Thorndike had objected to the older concepts of association of ideas and substituted the associations of stimuli and responses, but the Gestalt school objected to the concept that perception can be analyzed into elements. They feel that we do not associate mental or behavior elements but perceive, think, learn and act in an integrated manner which is more than a sum of or an association between parts, and their investigations of apparent movement, figure-ground and learning seem to refute the association-of-elements concept.[7] Wolfgang Koehler investigated the learning process in monkeys.[8] Consider a monkey in a cage who has become accustomed to using a stick for pulling in a banana placed beyond his reach outside the cage. But now two sticks are provided, neither long enough to reach the banana but made so they can be joined together to make one stick of sufficient length. When

placed in this situation the monkey tried first one stick, then the other, and finally gave up with some of the behavior attitudes which would be regarded as frustration in a human. After some moments of listlessness the monkey, suddenly acting in an excited manner, ran around to the two sticks, attempted to join them together and finally succeeded. He then reached out with the double length stick and obtained the banana. Other monkeys learned to pile boxes to reach lures placed higher than they could reach or jump.[9] These experiments point to an understanding, a visualization of a means of reaching a goal without trials or errors. Comparable experiments on dogs and other animals point to a similar understanding in simpler situations.

Insight occurs in humans as has been demonstrated on children[10] and on adults learning archery.[11]

With this background we can approach experimental studies of learning to observe how these factors operate. Ruger[12] investigated the acquisition of skill in solving a mechanical puzzle. He found the steps to be: (1) The total process was broken down into a series of steps; (2) Each of these steps was mastered in sequence; (3) By anticipation of the next step while the one before it is carried out, the sequence becomes integrated into one smooth process. During the trial marked X the subject used additional time to study certain aspects which resulted in better performance on subsequent trials.

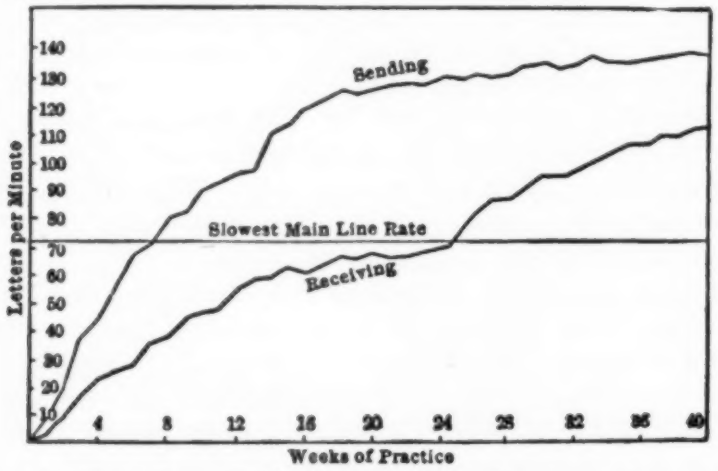

Figure 2. (From Bryan & Harter, 1897.) Learning curves of one student of telegraphy, tested once a week in sending and receiving connected messages.

Telegraphy was studied by Bryan & Harter.[13] Several stages were observed; first learning the alphabet and spelling out each word in sending and receiving. After much practice the word becomes a unit and even before this stage is complete, the third stage, organization on

a phrase or short sentence level, begins. In sending he learns to anticipate the motor performance. In receiving he also anticipates the motor performance by copying behind, which enables him to get the sense of the message before writing it down.

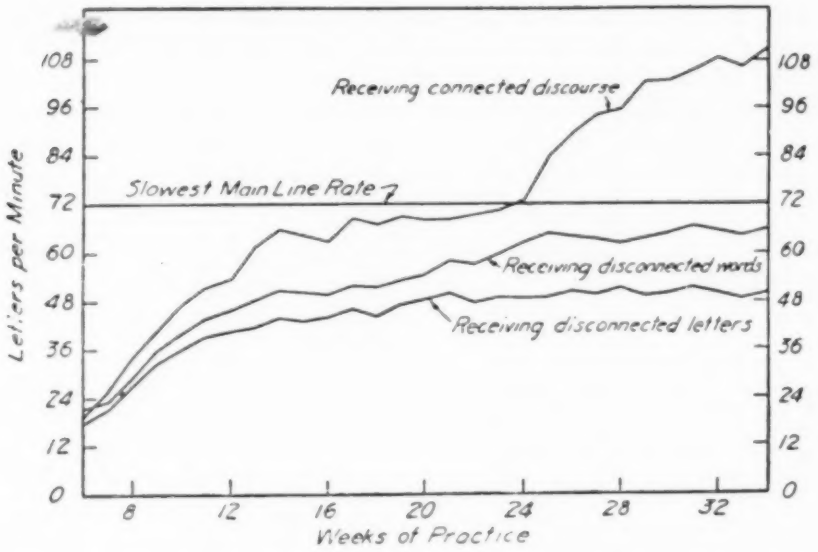

Figure 3. (From Bryan & Harter, 1899.) Learning curves of another student who had begun the study about 6 weeks before the first of the weekly tests. The three curves show progress in *receiving*: bottom curve, disconnected letters; middle curve, disconnected words; top curve, connected discourse.

This study is valuable because it indicates the relative values of various factors. Notice that sense messages are received faster than isolated words, and that these, in turn are received faster than single letters. Insight has greater scope in sense messages which accounts for the more rapid rate. The anticipation of motor performance also involves insight to a degree. On the other hand the behavior unit starts with elements as the performance units to be placed in sequence (i.e., associated). It proceeds toward making words the units. While this has no direct application to training, the concept of bulding elements into more complicated behavior elements which become units themselves is characteristic of some forms of visual perception as reading and the development of stereopsis.

This study also illustrates the plateau, which is a period in which the measurable performance is not improving. Jordan[14] gives three possible explanations: (1) A period when the simpler responses are becoming automatic; (2) Lack of interest; (3) Arrival at a more

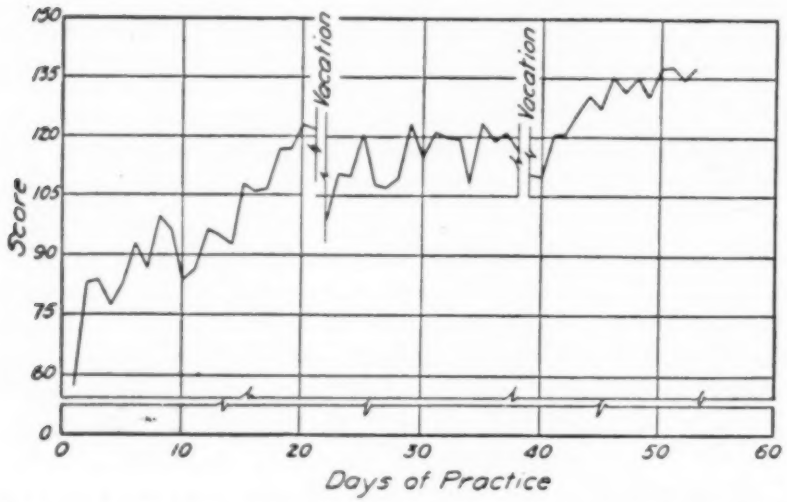

Figure 4. (Data from Smith, 1930.) Learning curve of one subject, practicing the game of ringball with two hands. Each hand had a ball. The alternate throws of right and left hand were timed by a metronome to occupy about 3 seconds each. A set consisted of 20 shots with each hand, and a day's practice contained 5 sets. The practice came three times a week, but was interrupted by two vacations, after each of which there was a low start with prompt recovery. But after the first vacation the previous rapid progress was not resumed; instead we see a plateau lasting 6 weeks and only left behind after the following vacation. The cause of the long arrest of improvement, though not perfectly clear, seemed to be a lack of equality and coordination between the different parts of the performance, especially between the two hands. The right hand needed to hold back, apparently, and let the left hand catch up, before the two could work well as a team.

difficult stage in the learning process. The optometrist should be wary of plateaus and try to shorten them by eliminating the cause.

The preceding studies show the value of exercise and effect and the relative merits of learning by trial and error and by insight. In all probability, pure insight or pure trial and error behavior does not occur. Woodworth[15] holds that "trial and error as we find it, consists not in blind and purely random movement, but in trying this and that lead to the goal. As far as we can judge from the animal's behavior there is always some perception of the objective situation, as there is in the maze."

"The other side of the picture is that this perception is never complete at the outset, in any situation that can be called problematical." We can agree that both insight and trial are necessary in achieving the end or goal; and that insight occurs to a greater degree when the solution is simpler or more familiar, trial when it is more complex or strange. It appears highly probable that learning occurs more quickly by insight than by trial and error.

We may conclude with Jordan's[16] outline of the steps in the learning process:*

(1) Set or adjustment ". . . motivated so that he will desire the goal. Unless there is some direction given to his experiences by a set or adjustment very little learning will take place."

(2) Selection of the proper responses.

(3) Elimination of wrong responses by, a) desire to improve, b) selection of a desirable substitute which is rewarded whenever possible, and c) cause some annoyance to accompany the incorrect response.

(4) Fixation of experience by, a) intensity or vividness, b) exercise or repetition, c) belongingness,† d) satisfaction.

(5) Integration and organization—if the new hierarchy of habits have use they will become reinforced.

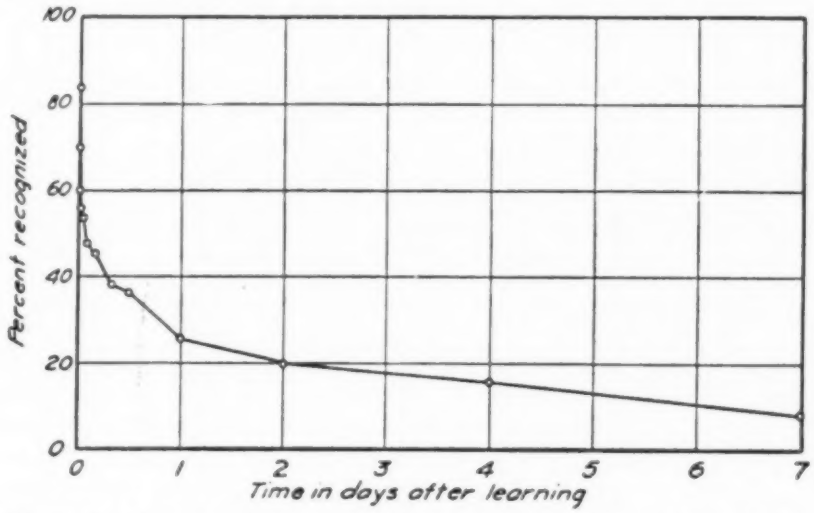

Figure 5. (Data from Strong, 1913.) Curve of retention as determined by the recognition method. The material consisted of "all the common ordinary words," not over 3 syllables in length, found in the Standard Dictionary. Lists of 20 words were presented visually and were read aloud by O "slowly enough to grasp the meaning, but fast enough not to form associations between them." At the bottom of each list was a short problem in arithmetic to be solved mentally as soon as the list had been read, so as to prevent any immediate rehearsal of the words. In the recognition test the 20 words were mixed with 20 others, and O designated those which he was sure were in the original list. The score here plotted is that of these confident recognitions, with penalty for new words falsely recognized. Only one list of words was studied at a time, and the recognition test on each list was given before any other list was learned. There were 5 Os and 15 lists in all for each interval between learning and test.

*Modern Instrumental Conditioning may throw light on these processes. See Hilgard, E. R., and Marquis, D.G., "Conditioning and Learning." Appleton, N. Y., 1940.

†Intrinsic Relationship.

Now for a brief word regarding retention, which has been investigated by psychologists as its opposite, namely, forgetting. The first diagram is Strong's[17] curve of retention for words seen in a given list (the second shows it plotted in log units or what Lecomte du Nouy calls biological time). We shall be concerned with factors which are aids to retention. Most important is overlearning provided attention is maintained.[18] Krueger's data[19] shows some advantage for "recalling" or anticipation of the next step and a larger gain in the amount "saved" or the relearning score. Both Krueger and Ebbinghaus[20] feel that retention is roughly proportional to the amount of original learning.

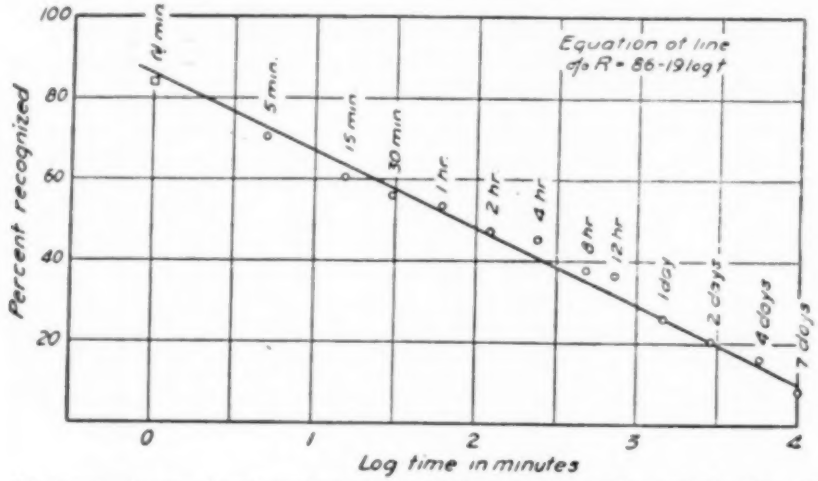

Figure 6. Scores plotted against the logarithm of time. The straight line, drawn in simply by the eye, is a fairly good fit, and the inference is that the retention decreased just about in step with the logarithm of time—or that forgetting (loss of retention) increased as the log of time.

Other factors are involved. Spaced learning periods are better than repeated learning.[21] Meaningful material is more readily retained than nonsense.[22] Motor skills are retained for long periods, but they are, in general, overlearned.[23] Vividness as stressed by Jordan, is a factor brought out by Van Buskirk,[24] among others.

The last item of our definition was transfer. Our question is: "Can the correct response as learned in the training room be transferred to everyday existence?" This is the most important step in our training procedure, and the one about which we know least. Renshaw has found that tachistoscopic digit training results in increased reading speed and comprehension, measured by standard tests.[25] Webb[26] found that maze learning is transferable to other mazes. Other examples of transfer are present in psychological literature, but our approach to it should

be cautious and tentative. The requirement here is for us to investigate the problem directly; that is, "To what extent are the skills improved by orthoptic training carried over to useful normal existence?" Tentatively we might say that the greater the similarity between the training and the normal use situation the greater the amount of transfer will be.

Now let us turn about and consider the reactions of an individual when confronted with a problem or situation to be learned. Goldstein finds the behavior of an individual at such a time can be "ordered" on one hand or "disordered" or "catastrophic" on the other. When behavior is ordered, "responses appear to be constant, correct, adequate to the organism to which they belong, adequate to the species and to the individuality of the organism as well as to the respective circumstances. The individual himself experiences them with a feeling of smooth functioning, unconstraint, well being, adjustment to the world and satisfaction . . . a total pattern in which all the involved factors participate in a fashion appropriate to the performance in question." "The catastrophic reaction on the other hand is not only inadequate but also disordered, inconstant, inconsistent and embedded in physical and mental shock . . . He is in that condition which we usually call anxiety."[27] In time there will be a return to an ordered behavior. Goldstein (and myself as well) does not wish to imply that all disordered behavior is as extreme as the word "catastrophic" might signify. It can be slight or severe, and can last for varying periods. But clearly learning can occur best when ordered behavior is present. But what can cause disordered behavior? Goldstein's work points to a feeling of inability to perform a task even before it is attempted. This was more apt to occur when the problem was abstract, providing the task could not be brought down to a more concrete level. As an example of Goldstein's meaning this statement is sufficiently abstract to require a more concrete substitute so I shall give one of Goldstein's examples: a patient with a cortical lesion, when given the Holmgren wool color test samples could not select all those which looked red, since this required utilization of the abstract knowledge of redness. But when given a sample of red, another sample could be matched closely to it. By this concrete process of matching, a row of red skeins was selected, each one matched to the previous skein. Thus the first, abstract, task was avoided, the second, the more concrete problem of matching, was attacked successfully and with normal behavior. In general the behavior of his patients was more apt to be normal when the situation was orderly or familiar or concrete than when disarranged or strange or abstract.

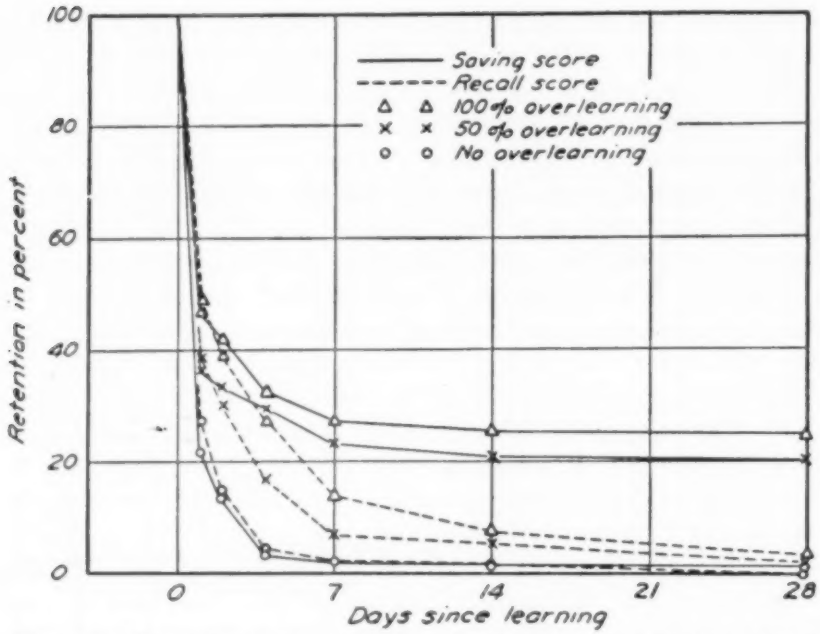

Figure 7. (Data from Krueger, 1929.) Retention after overlearning. Lists of 12 monosyllabic words, all nouns, were presented on a rotating drum at the rate of 2 seconds per word. After 4-5 presentations, on the average, O anticipated all the words in a list. The number of presentations needed in each case to reach this criterion was noted, and in some cases learning stopped there, but in other cases additional presentations were given till the total number was 50 or 100 per cent greater than the number needed to reach the criterion. After an interval of 1 day or more, O relearned the list to the same criterion, and two retention scores were obtained: the regular saving score and the "recall score" which was the number of correct anticipations on the first relearning trial. Separate groups of 20 students relearned after the different intervals. Errors due to inequality of the word-lists were avoided by using the same lists for each interval and by rotating the lists among the members of each group. The averages plotted have high reliability. On the graph the label "100% overlearning" means that the number of additional presentations was equal to the number required to meet the criterion.

Of course, objection can be raised in that his subjects were "patients" and not normal individuals. Goldstein discusses this point at length. I, for one, am willing to draw the following inferences from his work: first, that if a task *can* be performed, taking all factors into consideration, normal behavior ensues. If not, substitute performance with normal behavior is likely to occur and if that is not possible disordered behavior can be expected. The second point is that when the problem is more abstract the correct behavior response or solution is less likely to occur.

What then, can we learn from this approach? First, that simulation or substitute performance can replace expected performance. This is a great hazard in training fusion in squint cases. Secondly, that if the

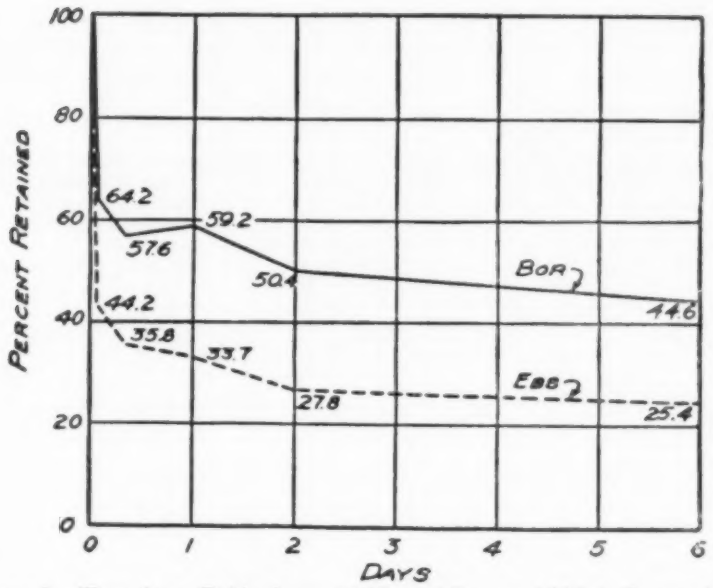

Figure 8. (Data from Ebbinghaus, 1885, and Boreas, 1930.) Curve of retention of lists of nonsense syllables, as determined by the saving method. The Ebbinghaus curve is from one O about 40 years old, who learned and relearned over 1,200 13-syllable lists. The Boreas curve gives the average for 20 students, each learning one 15-syllable list for each interval. Continuation of these curves is included in Figure 9.

task is too difficult, disordered behavior can result, so that excessive difficulty is to be avoided. Thirdly, that the degree of difficulty depends on the amount of three factors: (1) complexity; (2) abstractness; and (3) unfamiliarity. Accordingly, our procedures should be as simple, as concrete, and as familiar as possible.

Before we leave basic psychology, it is probable that the general question of motivation should receive more attention. We must remember that motivation is implied in the work of both Thorndike and Koehler, that overlearning is of value to retention, particularly if attention is maintained. While the reasons behind drives and motives are subject to some dispute, (that is whether they are basically instincts or something else) the existence of these drives is not open to dispute. In fact, the closer we get to everyday life, the greater is the emphasis placed upon motivation.[28] A partial list of motives would include: escape from danger (fear), combat (anger), repulsion, parental protection, distress, sex instinct, curiosity, submission, self assertion, gregariousness, acquisitiveness, hunger, creativeness.[29] These motives have emotions at their core and it is up to us to obtain both the most effective emotional state and motivation. Woodworth[30] states that "a motive then, is a state or set of the individual which disposes him

for certain behavior and for seeking certain goals." The writer's experience points toward pleasantness and self satisfaction through achievement, praise and reward wherever possible, as good motivation in orthoptic training.

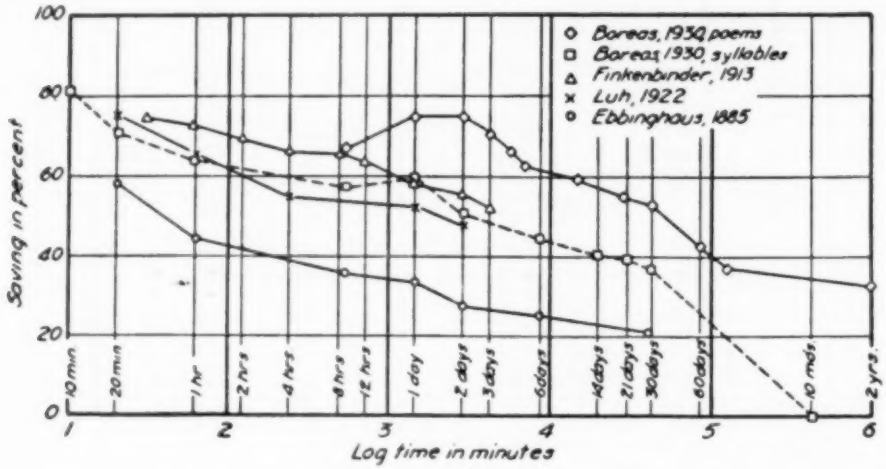

Figure 9. Several retention curves plotted on a logarithmic abscissa. A straight line would fit any of them fairly well, aside from a dip at 8 hours when no correction has been made for diurnal variation, and aside from the drop at 10 months which suggests an eventual complete loss of barely learned nonsense material. The lessons were syllable lists except for the uppermost curve, which was obtained from 20 students whose high retention of poetry may be due in part to voluntary or involuntary rehearsal during the interval between learning and retention test.

Jordan[31] places a good deal of emphasis on conditions of learning: grouped under three headings.

A. Physiological conditions: Senses must be adequate, general health good, no glandular difficulties, urges or drives satisfactory, adequately functioning effectors.

B. Psychological conditions. Motives and interests satisfactory. "The most rapid and satisfactory learning occurs when the individual sees that what is being learned is significant for him, is forwarding his aims, is helping him approach a goal which seems to him consequential." The interest may be intrinsic, i.e., contained in the material itself. To augment this interest, we may deviate from a logical development of the learning sequence toward one which is psychologically advantageous. The interest may be extrinsic, that is in achievement of the goal. On the other hand the interest can be collateral, on the basis of competition, on approval, or disapproval, and on rewards or punishment.

C. Educational conditions: Material selected to be of interest to

the individual in his own experience, and are most suitable when they are familiar.

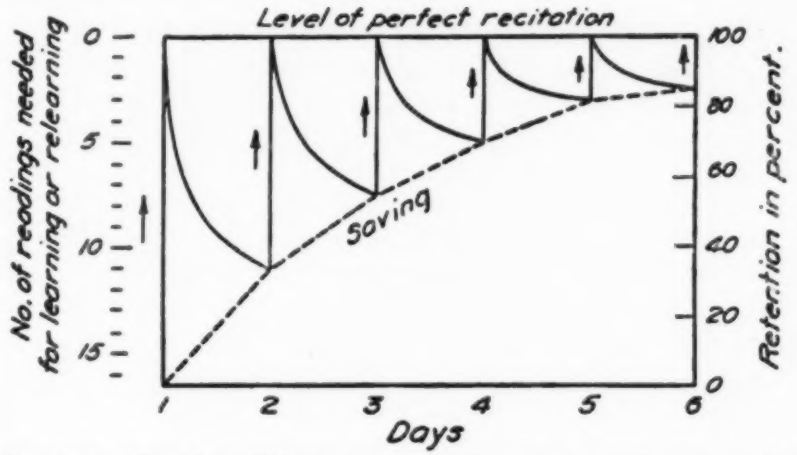

Figure 10. (Data from Ebbinghaus, 1885.) Forgetting is made slower and slower by repeated learning of the same lesson. The "lesson" in this case was a list of 12 nonsense syllables, or, rather, a set of 9 such lists learned in immediate succession in a sitting of about 15 minutes, and relearned day after day, always to the point of one correct recitation. The number of trials to learn (relearn) decreased day by day; the saving increased; retention was better and better. The arrows indicate the daily learning by which mastery was pushed up to the recitation level. The curves show the probable course of forgetting during each successive period of 24 hours. The data are the average results from learning and relearning 63 lists.

Thus good motivation is stressed by the educational psychologist to an extent which should make us extremely cognizant of its value.

Let us end the theoretical part of the paper on this note and proceed to see how this basic material is applied in a nearby field, remedial reading. For a given individual at a given time Betts[32] recognizes four levels of difficulty.

(1) The basic level—on which the individual can perform smoothly and easily.

(2) The probable capacity level—the maximum that the individual could ever be expected to master.

(3) The frustration level—on which activity results in disordered behavior. It lies naturally enough between the levels of (1) and (2).

(4) The working level will lie above the basic level and below the frustration level. Here learning is most effective.

In orthoptic training the learning process can usually be outlined in advance, starting at the basic level and ending at the probable capacity level. This sequence applies equally to improvement of visual acuity, development of fusion and stereopsis, and the like. (The only kind of training to which it does not seem to apply is kaleido-

scopic training.) What, then, are the general rules for training room procedures?

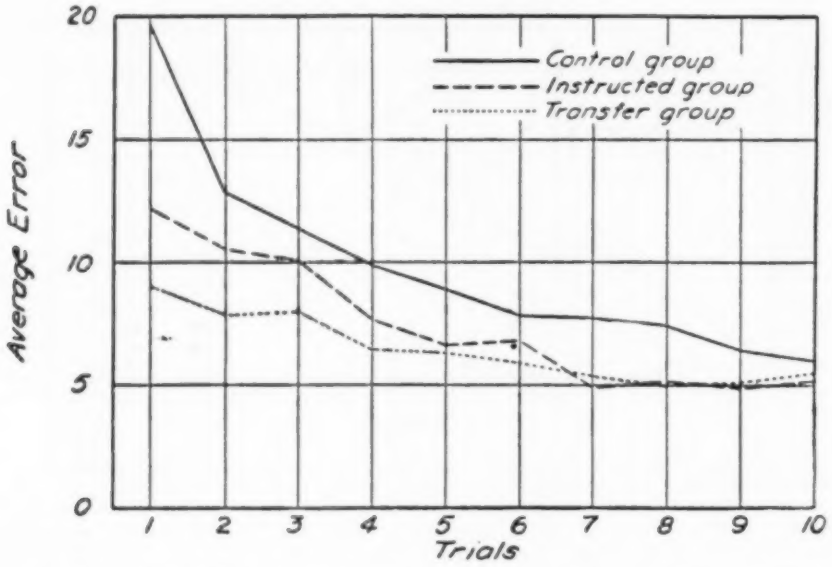

Figure 11. (From Bray, 1928.) Transfer from hand to foot in mirror target practice. The target was a vertical line on a frontal-parallel sheet of paper straight in front of O's hand or foot, concealed by a screen from direct vision but visible in a mirror. The mirror was vertical, perpendicular to the plane of the target and somewhat to O's side. It reversed right and left. For the hand practice, the pencil with which the hits were made was held in the right hand; for the foot practice, the pencil was attached to a light block of wood which was strapped to the right foot, and the foot hung free in front of the target, the thigh being supported while O sat in an elevated chair. The hits were required to keep time with a metronome beating 72 times per minute: a forward jab at the target was made at one beat and a backward movement to the starting point at the next beat, and so on till 10 hits were made at the target, the 10 hits constituting one "trial." O tried to correct his aim between hits and in so doing was at first misled by the mirror reversal. The control group of 24 students did the foot practice without previous hand practice; the transfer group of 37 students had at least 10 "trials" with the hand before starting with the foot; the instructed group of 17 students had no previous practice but were made familiar with the setup and with the mirror effect by visual demonstration and were told an efficient way of correcting their errors and escaping from the mirror effect. The curves indicate that the instruction helped the feet considerably but not as much as actual hand practice.

We can start with a discussion of selecting patients. After we decide that the condition is remediable, we must decide whether the patient is a good "risk" from other points of view. The selection here becomes a weeding out of those less likely to succeed. Those in poor physical health may be advised to postpone training. A level of intelligence too far below average can be a handicap. A neurological lesion can make training inadvisable. These and other physiological factors must be evaluated. A sharp line cannot be drawn at an arbitrary level for any

one factor, and the optometrist must be guided by his experience and judgment.

Motivation is a very important factor. To attain it, it is desirable and necessary for the optometrist to advise the patient what the probable benefits will be, in terms of the patient's everyday existence. If the patient is a child we must consider the motivation of both the parent and the child (rather than just the parent). The question of age as a basis for not considering training was purposely left until now. The writer has helped some individuals who were far beyond the customary upper age limit. Usually they are advised of the additional handicap induced thereby. One such patient who was well satisfied with the results obtained, admitted very frankly when she was about to be dismissed, that knowledge of the age handicap made her very determined to perform the requisite tasks. Very young patients have a rather short span of attention, so that in the pre-school child one rarely gets enough work done at each visit to justify the training, but if the condition warrants immediate attention an attempt can be made. Of course, Worth[33] and others have stated a preference for the pre-school child in squint training, but my experience inclines me in the opposite direction. In young children, tractability, or its lack, is an important consideration.

With many patients the question of conflict with social obligations often comes up. The requirements of the job, piano lessons, athletics, scouting, or even social popularity, can appear too important to allow time for training. When the patient stresses this point to excess, the writer will not accept the case because a lack of proper motivation is implied. Finally, some patients give excellent signs of neurasthenia. They are rarely capable of being satisfied and often do not complete the training advised, so that it is best not to start. Again may I stress that selection will often depend on judgment and experience. Of course one can offer a trial period and postpone the decision until its end.

The training room should be of ample size so that patients are not in each other's way. The question of how many patients can be trained at once is really a question of how many patients the optometrist and his staff can handle at once, and depends on temperament, space, amount of equipment, and types of cases. However, it is not wise to leave the training room unattended.

The training room attitude should be warm and friendly. It should be sympathetic and understanding with an underlying attitude of confidence in the patient's ability to perform the task at hand. A new task should be explained to the patient very carefully and he

should be told how the desirable result will appear to him. For an example in training fusion, he should be told how the object should look when fused. This permits the use of insight and goal-seeking behavior which our psychologist friends have found so valuable. Of course simulation can occur, but if so it can be discovered by the use of test situations saved for that purpose. Another pertinent example of the importance of correct patient instruction occurs in training pursuit ability. When the eye motion is jerky, our advice cannot be to "move your eyes smoothly." It must take the form of "Are you watching the target very carefully? I think you are lagging behind in places."

To aid in maintaining motivation the procedures employed should be intrinsically interesting wherever possible. Printed material should be of a proper grade level for the patient at hand. The locale of stereoscopic scenes can be explained. Improvement should be directly visible to the patient if possible. The pointer technique is valuable in this regard. Occasionally such improvement can only be indirectly visible, as in duction training, where we can let the patient know what prism value is being overcome. Also praise should be given for successful completion of a task, particularly if the task does not provide intrinsic motivation.

The question arises as to where we ought to start training and how fast ought we to go. With regard to the skill being developed there is a level which can be performed easily, without effort and without tension. This is the "basal level" and is performed under conditions of "normal behavior." A higher level of activity can easily be seen to be the "frustration level" which can result in general nervous and muscular tension, difficulty, and in a hesitating performance, and possibly in a desire to avoid or circumvent the task—in other words the patient is reacting with somewhat "disordered" behavior. Our training level should start just above the basic level and proceed from there upwards, being very careful to watch for these signs of frustration or disordered behavior. If some signs of it are observed, it might be wise to work on a slightly lower level.

Plateaus, or continued activity without being able to perform the next level at all can be as a result of inattention or because the step is too large for the patient at hand. The patient may be shifted to some other technique to accomplish the same end, or the step interval may be divided into parts, and given in smaller steps. This can call for some resourcefulness on the part of the optometrist.

Another question that arises is how much training should be given. If the skill is basic to some other skill, as fusion is to stereopsis,

overtraining is not particularly necessary. But there are some skills which do not underlie subsequent training, such as tachistoscopic or accommodative facility training. In the latter case when the desired level is reached on say three or four successive training periods, training proceed to something else. Of course there should be periodic checks on whether the advancement is maintained, and retraining given if necessary.

If the original condition resulted in some particular symptom or inefficiency in daily life, the patient should be asked from time to time whether any improvement has been noticed. This will aid in motivating training or in discovering if the training is not alleviating the symptoms or problems of the patient. In many cases the examination findings improve, without noticeable improvement in comfort; and in many others the patient's visual symptoms diminish without change in the findings. In other words, an estimate of the correlation between symptoms and findings does not seem to be as good as we might like it to be. Since our object should be alleviation of the symptom,[34] it must remain the direct, and the findings the indirect, yardstick of the value of the training.

One last word about patient dismissal. You will recall that overlearning aids retention, and in general that spaced learning is preferred to massed learning. Consequently it would appear preferable to "taper off" training gradually, rather than to dismiss the case abruptly.

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The diagrams were obtained from R. S. Woodworth's Experimental Psychology, Holt, N. Y., 1942, and are printed with their permission.

ABSTRACTS

NOTES ON SUBJECTIVE REFRACTION, L. A. Swann. The Journal of the Institute of Chemists-Opticians. (London). 5, 14, 395-396, 1948.

To avoid refractive pitfalls, the author points out that as the patient's age increases hyperopia increases too, while at the same time the older myopic patient will find his myopia decreasing. With advancing years the patients with astigmatism with-the-rule will find the amount of error decreasing, while the one with astigmatism against-the-rule will increase. The axes will change very little he points out, but the non-presbyope with a +0.50 D. cylinder axis 90 may change to axis oblique in the process of becoming an astigmat against-the-rule later in life. The opposite may occur in later middle age through lenticular changes.

The author suggests, that those who use minus cylinders in correcting hyperipic-astigmatic patients, transpose their final findings into trial lens corrections with plus cylinders to check the value of the cylinder in improving visual acuity. C.C.K.

AN INTRODUCTION TO THE CORNEAL (CONTACT) LENS, J. E. Tansey. The Canadian Journal of Optometry, July issue, 215-218, 1948.

The author believes that most of the problems of contact lens wearing have been due to the use of improper buffer solution. He, therefore, welcomes the new Tuohy-Solex Corneal contact lens as this requires no buffer solution. The author presents the development and theories upon which this new corneal contact lens is based.

C.C.K.

PRISMATIC PRESCRIPTIONS—A CLINICAL REPORT ON 147 CASES*

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INTRODUCTION

The cases covered in the following report were selected from the writer's practice because they demonstrate the value of prism in the prescription in instances where (1) orthoptic treatment was impractical from the patient's standpoint, and (2) where the case was not amenable to orthoptic correction, particularly in cases of vertical imbalance.

TECHNIQUE

Standard procedure for the general routine has been employed. The gradient test is also taken. The subjective technique has been described in a previous paper.[1] The system of analysis follows closely that described by Morgan[2] and the norms are based upon his table.[3] The "delayed subjective" technique was also used in all instances.[4] The correction through which all phorias and ductions were taken represented the most plus or least minus which gave maximum visual acuity before the introduction of prism. In testing for vertical imbalances, a target requiring maximum acuity was used; the prism before the left eye measured the phoria, while the prism before the right eye was used for measuring the vertical ductions, in order to eliminate the question of a discrepancy in the alignment of the rotary prism. The prisms were also checked from time to time for alignment.

Since it has been observed that a supraduction will reduce the amount of the infraduction taken immediately following it, the procedure used in taking the vertical ductions was to take the duction overcoming the hyperphoria before the duction conforming to it. Thus, if right hyperphoria was present, the right infraduction preceded the right supraduction, but if left hyperphoria was found, the right supraduction preceded the right infraduction. Under such circumstances, a disparity of the ductions agreeing with the phoria could not be considered induced. Where the vertical ductions contradicted the phoria, they were repeated at intervals in reversed order, and an average of the different repetitions used.

The decision to include prism in the final correction was based

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†Optometrist, Fellow, American Academy of Optometry.

upon the indications of the phorias and ductions and confirmed by the patient's subjective response. This subjective procedure involved placing the final correction in a trial frame and directing the patient to the test chart at 6 m., the reading card at 33 cm., and to a series of commercial signs visible through the refracting room window and located about 100 feet from the office. The patient was instructed that the prism, which was introduced before the lenses, might "make no difference, might make it better, or might make it worse," not always in that order of phrasing. The prism was presented several times, before both eyes in the appropriate position, and also several times in a reversed position, to overcome any psychological effects influencing the patient's reply. The patient's answers usually indicated a measurable increase in acuity, greater ease of seeing, blacker or steadier type, etc., where the prism was accepted. Agreement in results was sought at all three test points. If the subjective responses denied the implications of the clinical tests, no prism was prescribed.

THE TABLES

Each of the following tables lists the cases by sex, age, condition at start and final prescription, position of the base of the prism prescribed, phorias at 6 M. and 33 cm. and ductions concerned. Ductions at 33 cm. only are shown, since it was observed that in the main the far point ductions agreed with these in their implications. Changes in the correction of no more than 0.25 D. or 5 degrees in axis are indicated as no change. Changes of 0.50 D. to 0.75 D. or 10 degrees in axis are indicated by an M (more) or L (less): while changes of 1.00 D. or over are indicated by MM (much more).

VERTICAL IMBALANCES

1. Table 1 presents 42 cases in which a vertical prescription was accepted subjectively when indicated by agreement of the vertical phorias and ductions.

No significant difference in distribution by sex or age is revealed.

14 cases reveal no significant change between entering and final corrections.

10 cases show an increase in the amount of plus or decrease in the amount of minus.

2 cases accepted a marked increase in the amount of plus prescribed.

5 cases accepted less plus or more minus.

8 cases entered without correction and accepted plus.

1 case entered without correction and accepted minus.

1 case entered without correction and accepted no Rx but the prism.

1 case entered with minus and left wearing plus.

TABLE I. VERTICAL IMBALANCES. As Indicated by Phoria and Vertical Duction Findings.

Case Number	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed. (Base-down)	Hyperphoria at 6 M.	Hyperphoria at 33 cm.	Right Supra-duction	Right Infra-duction.
1.	M	12	+	L+	1△ O.D.	4△RH	2△RH	8/4	3/2
2.	F	15	O	+	2△ O.D.	2△RH	2△RH	6/2	2/1
3.	M	16	O	+	1△ O.D.	2△RH	2△RH	4/3	2/1
4.	F	16	+	+	2△ O.D.	2△RH	3△RH	8/6	2/1
5.	F	18	O	+	1△ O.D.	1△RH	1△RH	3/2	2/1
6.	M	10	+	+	1△ O.D.	1△RH	1△RH	4/3	3/2
7.	M	17	O	+	½△ O.D.	½△RH	½△RH	3/2	2/1
8.	F	19	+	M+	1△ O.D.	1△RH	2△RH	6/3	4/2
9.	F	19	−	−	1△ O.D.	½△RH	2△RH	5/3	4/2
10.	F	20	+	M+	1△ O.D.	2△RH	2△RH	7/4	3/0
11.	M	20	−	−	1△ O.D.	O	2½△RH	6/4	4/2
12.	M	21	−	−	1△ O.D.	1△RH	1△RH	4/3	3/2
13.	M	28	O	+	1△ O.D.	2△RH	2△RH	6/3	4/0
14.	M	29	−	M−	1△ O.D.	3△RH	4△RH	6/4	0/−3
15.	F	26	−	M−	1△ O.S.	3△LH	2△LH	(S)	(S)
16.	M	29	+	+	1△ O.D.	3△RH	3△RH	6/3	4/2
17.	M	22	O	−	1△ O.S.	1△LH	1△LH	3/1	4/2½
18.	M	28	O	+	1△ O.S.	2△LH	1△LH	3/0	5/2
19.	F	31	+	+	1△ O.D.	2△RH	2△RH	6/4	3/2
20.	M	37	+	L+	1△ O.D.	3△RH	4△RH	4/1	2/1
21.	M	36	−	L−	1△ O.D.	1△RH	2△RH	4/3	2/−1
22.	F	38	+	M+	1△ O.D.	1△RH	1△RH	2½/2	1/1½
23.	M	39	O	+	1△ O.D.	1△RH	2△RH	3/2	2/1½
24.	F	36	+	+	1△ O.D.	1△RH	2△RH	5/3	3/1
25.	M	32	+	+	1△ O.D.	½△RH	1△RH	5/3	3/1½
26.	M	45	+	M+	1△ O.S.	2△LH	2△LH	3/1	4/3
27.	F	44	+	+	1△ O.D.	2△RH	2△RH	6/3	4/1
28.	M	48	+	+	1△ O.D.	1△RH	2△RH	5/4	2/−1
29.	F	59	+	+	1△ O.S.	2△LH	2△LH	2/1½	4/2
30.	F	55	+	+	1△ O.S.	1△LH	1△LH	2/1	4/2
31.	M	51	−	L−	1△ O.D.	2△RH	3△RH	6/2	3/1
32.	F	50	+	M+	1△ O.D.	1△RH	1△RH	5/3	3/1
33.	M	55	O	O	1△ O.D.	3△RH	3△RH	5/2	2/1
34.	M	58	−	+	1△ O.D.	1△RH	2△RH	4/3	2/−1
35.	F	50	O	+	1△ O.D.	1△RH	1△RH	5/3	2/1
36.	M	67	+	L+	1△ O.D.	2△RH	2△RH	(S)	(S)
37.	M	60	+	+	2△ O.S.	2△LH	(S)	4/−2	8/4
38.	F	63	+	+	1△ O.D.	4△RH	4△RH	5/3	1/−2
39.	F	66	+	MM+	1△ O.D.	1△RH	1△RH	(S)	(S)
40.	F	62	+	M+	1△ O.D.	1△RH	2△RH	3/2	2/1
41.	M	63	−	L−	2△ O.S.	2△LH	4△LH	(S)	(S)
42.	M	81	+	M+	1△ O.D.	2△RH	2△RH	(S)	(S)

Explanatory legend. M = male. F = female. + = convex correction. − = concave correction. L = less plus or minus. M = more plus or minus. MM = much more plus or minus. RH = right hyperphoria. L.H. = left hyperphoria. (S) = suppression.

The distribution of hyperopes and myopes is not unusual.

The predominance of right hyperphoria may, however, be significant.

TABLE II. VERTICAL IMBALANCES. As Indicated by Phoria or Duction Findings but Not by Bo h.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed (Base-Down)	Hyperphoria at 6 M.	Hyperphoria at 33 cm.	Right Supra-duction.	Right Infra-duction.
43.	M	21	−	M−	1△ O.D.	1△RH	2△RH	2/1	2/1
44.	F	36	−	−	1△ O.D.	2△RH	2△RH	3/2	3/2
45.	M	37	+	+	1△ O.D.	3△RH	2½△RH	3/2	3/2
46.	F	59	+	+	1△ O.D.	O	1△RH	3/1	3/1
47.	M	64	+	+	1△ O.D.	1½△RH	2△RH	5/2	5/2
48.	M	34	+	M+	1△ O.D.	2△RH	2△RH	3/0	6/3
49.	M	33	−	−	1△ O.D.	2△RH	2△RH	1/0	4/2
50.	M	69	+	+	1△ O.S.	O	O	3/1	4/2

2. The first five cases listed in Table II illustrate cases in which the vertical prism was indicated by the phoria and accepted subjectively although not corroborated by the ductions. The next two illustrate cases in which the direction indicated by the phoria is contradicted by the ductions. The final case illustrates one in which the phoria offers no indication of imbalance but the ductions do.

In all of these eight cases prism was accepted subjectively.

6 cases reveal no significant change in correction.

2 cases reveal an increase in acceptance of plus.

3. Table III illustrates four cases which must be considered individually.

Cases 51 and 53 are the only cases of vertical prism which have required the removal of the prism originally prescribed, insofar as the writer knows. Case 51 wore the prism with comfort for six months, then began to have difficulty, and upon examination about one year later, no longer revealed an imbalance. Case 53 indicated no prism about two years before the examination from which the illustrated findings are taken. In the more recent examination, she accepted the prism subjectively, but after wearing the correction about 10 days complained of dizziness when looking to the left. Reexamination revealed the same findings, except that a further probe resulted in demonstrating right hyperphoria when vision was directed to the right, but left hyperphoria when vision was directed to the left of the primary position. The prism was removed as no correction was practical.

Case 52 accepted a prism subjectively which contradicts the indications of both the phoria and ductions. This patient had been wearing prism base-down before the left eye, and suffered some anisometropia. It is the writer's belief that she suppressed one eye, and that the prism

TABLE III. VERTICAL IMBALANCES. Unusual Findings or Results.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed. (Base-down)	Hyperphoria at 6 M.	Hyperphoria at 33 cm.	Right Supra-duction.	Right Infra-duction.
51.	M	24	O	+	1△ O.D.	1△RH	1△RH	4/3	3/2
		Patient used the correction for one year and then returned reporting headaches. At this time no prism was indicated and a non-prismatic correction was prescribed.							
52.	F	62	+	+	1△ O.S.	½△RH	1½△RH	4/2	3/1
		In this case the correction prism is opposite to indicated prism. The patient subjectively preferred the prism as prescribed.							
53.	F	40	— mix. astig.		1△ O.D.	½△RH	1½△RH	4/2	3/1
		Patient unable to use this prismatic correction. A retest disclosed right hyperphoria in the primary position and to the right, but left hyperphoria to the patient's left. With the prism in place and viewing objects to the left the patient experienced diplopia.							
54.	F	71	+	M+	2△ O.D.	(S)	(S)	(S)	(S)
		In this case the prism was determined subjectively without other indications upon the basis of definitely improved visual acuity.							

she finally accepted aided in moving the image farther from the fovea and abetted her suppression. She reported that corrections attempted without prism had not been as comfortable.

Case 54 represents a case in which no phorias or ductions could reliably be recorded, but prism determined subjectively markedly improved the binocular visual acuity.

SUMMARY

Of a total of 54 cases in which vertical prism was prescribed, the writer has had only two cases return to him with a complaint which necessitated removal of the prism. This is not, however, indicative since only about half the patients have reported back, and the writer cannot determine whether any of the remainder visited another practitioner and if so, whether the prism was continued or not. He has heard from enough to know that a large group of patients are wearing the prism with comfort.

No significant breakdown seems revealed by segregation into age groups, or sex, or hyperopia and myopia.

In 20 cases there was no significant change in the correction.

13 cases revealed an increase in plus or decrease in minus.

2 cases accepted markedly more plus.

5 cases accepted less plus or more minus.

10 cases entered without correction, of which 8 accepted plus, and 1 minus, while one accepted no correction.

1 case entered wearing minus and left wearing plus.

While it would be difficult without controls to determine whether the increased comfort reported by many was due to the prism or to the change in correction, in the 20 cases in which no significant change was found, plus the case in which no correction was prescribed, plus case 54, in which prism improved the vision very markedly, there seems to be a strong tendency toward ascribing the change in comfort to the prism.

LATERAL IMBALANCES

1. Table IV presents 34 cases in which prism was prescribed base-in, and was indicated by conformity of the phorias and ductions, and accepted subjectively.

TABLE IV. LATERAL IMBALANCES. As Indicated by Phoria and Duction Findings. Base-in Prismatic Corrections.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed (Base-in)	Phoria at 6 M.	Phoria at 33 cm.	Duction at 33 cm. (Base-in)	Duction at 33 cm. (Base-out)
55.	F	13	+	+	1△	4 exo.	9 exo.	9/3	22/16
56.	F	19	+	MM+	2△	3 exo.	12 exo.	5/0	24/12
57.	F	18	O	O	1△	1½ exo.	8 exo.	12/2	24/12
58.	F	17	O	O	2△	4 exo.	9 exo.	8/0	24/22
59.	F	19	−	M+	2△	4 exo.	?	24/−2	26/16
60.	M	28	O	+	1△	2 exo.	11 exo.	8/−4	16/6
61.	M	22	O	+	2△	6 exo.	11 exo.	8/2	16/4
62.	M	22	+	M+	1△	2 exo.	11 exo.	18/0	22/14
63.	F	24	O	+	1△	2½ exo.	12 exo.	10/6	24/16
64.	F	22	+	+	1△	4 exo.	14 exo.	9/8	28/20
65.	M	30	−	−	1△	2 exo.	13 exo.	20/2	23/16
66.	F	31	O	+	4△	4 exo.	13 exo.	11/−2	24/16
67.	M	38	−	M+	1△	2 exo.	11 exo.	3/−4	22/16
68.	F	38	+	+	1△	3 exo.	10 exo.	13/2	24/20
69.	F	35	O	+	1△	2 exo.	8 exo.	5/−2	20/18
70.	F	33	O	+	1△	2½ exo.	9 exo.	12/−1	21/18
71.	F	31	+	MM+	1△	2 exo.	9 exo.	12/8	20/12
72.	M	38	+	+	1△	3 exo.	10 exo.	14/6	22/18
73.	M	48	O	+	2△	3 exo.	9 exo.	22/−6	24/16
74.	F	42	+	+	1△	2 exo.	11 exo.	15/−1	23/17
75.	F	49	+	+	1△	1 exo.	9 exo.	16/0	18/12
76.	F	47	+	+	2△	5 exo.	14 exo.	32/0	22/20
77.	F	43	O	+	1△	2 exo.	9 exo.	14/6	20/13
78.	M	43	+	+	1△	2 exo.	11 exo.	5/−2	20/12
79.	M	46	+	M+	1△	3 exo.	12 exo.	12/−3	24/16
80.	F	48	+	M+	1△	2 exo.	13 exo.	24/−1	24/20
81.	M.	45	+	+	1△	3 exo.	12 exo.	8/2	24/18
82.	M	43	O	+	1△	2 exo.	10 exo.	8/−6	22/16
83.	F	48	+	MM+	1△	2 exo.	14 exo.	24/−8	24/16
84.	F	54	+	M+	1△	2 exo.	12 exo.	16/−10	29/22
85.	M	51	+	+	2△	1½ exo.	10 exo.	7/2	24/17
86.	M	52	−	M+	1△	½ exo.	9 exo.	4/−8	26/19
87.	F	53	+	M+	1△	2 exo.	14 exo.	18/−2	24/18
88.	F	69	+	L+	1△	3 exo.	9 exo.	6/−8	(S)

Insofar as segregation by age, sex or plus or minus is concerned, there is a peculiar distribution of teen-age females in relation to males in this table.

11 cases reveal no significant changes in correction.

5 cases show an increase in plus when prism was used.

3 cases reveal a marked increase in plus with prism.

1 reveals a decrease in the plus accepted.

9 entered without correction and accepted plus.

2 entered without correction and accepted no prescription other than prism.

3 entered wearing minus but accepted plus with the prism.

2. Table V includes 28 cases in which prism base-in was accepted subjectively although it was not indicated by agreement between the

TABLE V. LATERAL IMBALANCES. As Indicated by Phoria and Duction Findings but Not by Both. Base-in Prismatic Corrections.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed (Base-in)	Phoria at 6 M	Phoria at 33 cm.	Duction at 33 cm. (Base-in)	Duction at 33 cm. (Base-out)
89.	F	18	O	+	2△	4 exo.	16 exo.	24/12	26/20
90.	F	19	+	M+	2△	2 exo.	11 exo.	22/10	18/12
91.	F	19	O	M+	2△	3 exo.	14 exo.	24/16	22/12
92.	F	17	O	M−	1△	3 exo.	9 exo.	24/12	24/18
93.	F	18	O	+	1△	2 exo.	14 exo.	16/8	24/13
94.	F	18	−	L−	1△	4 exo.	9 exo.	26/18	26/8
95.	F	15	O	+	1△	2 exo.	12 exo.	22/12	20/18
96.	F	26	−	+	1△	3 exo.	10 exo.	20/7	22/18
97.	F	21	−	M+	1△	3 exo.	10 exo.	20/16	17/9
98.	F	23	O	+	1△	2 exo.	9 exo.	22/19	28/24
99.	F	26	O	+	1△	2 exo.	11 exo.	20/14	22/11
100.	F	46	+	+	1△	3 exo.	18 exo.	20/12	24/23
101.	M	33	O	+	1△	3 exo.	13 exo.	15/10	19/15
102.	M	34	+	+	1△	2 exo.	11 exo.	16/10	20/11
103.	M	30	+	+	1△	2 exo.	9 exo.	16/7	26/23
104.	F	30	+	+	2△	3 exo.	11 exo.	12/4	11/3
105.	M	46	+	+	½△	½ exo.	3 exo.	8/0	20/15
106.	F	42	+	M+	1△	1 exo.	4 exo.	14/0	16/10
107.	M	45	+	M+	1△	1 exo.	6 exo.	14/−2	24/15
108.	F	45	−	L−	1△	2 exo.	6 exo.	(S)/−8	24/16
109.	F	16	O	−	1△	3 exo.	1½ exo.	16/8	30/24
110.	F	17	O	+	1△	2½ exo.	5 exo.	22/14	21/16
111.	F	17	+	+	1△	1 exo.	9 exo.	14/9	12/6
112.	M	21	+	+	1△	2 exo.	8 exo.	20/10	18/2
113.	M	33	O	O	2△	3 exo.	7 exo.	20/8	16/12
114.	F	36	−	L−	1△	1½ exo.	9 exo.	20/5	22/18
115.	F	39	O	O	2△	1 exo.	8 exo.	16/8	24/16
116.	M	49	O	+	1△	1 exo.	7 exo.	18/12	16/10

phorias and ductions. The first 16 are indicated by the phorias but not by the ductions; the next four reveal little discrepancy in the phorias but show lack of reserve in the ductions; while the final eight are almost on the borderline in both phorias and ductions, but because of contradictions between the far and near phorias, or discrepancies between monocular and binocular acuity, were assumed to have some involvements in their convergence.

In this group is revealed again the predominance of teen-age females.

7 cases show no significant change in correction.

6 accepted less minus or more plus.

13 entered without correction, of which 9 accepted plus, 2 accepted minus, and 2 accepted no correction other than prism.

2 entered wearing minus and accepted plus with the prism.

3. In Table VI, we have four cases in which lateral prism was prescribed which require individual consideration. Cases 117 and 119 are

TABLE VI. LATERAL IMBALANCES. Unusual Findings or Results. Base-in Prismatic Corrections.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed (Base-in)	Phoria at 6 M.	Phoria at 33 cm.	Duction at 33 cm. (Base-in)	Duction at 33 cm. (Base-out)
117.	F	19	O	+	1△	4 exo.	12 exo.	24/11	22/10
		Vision blurred with prism. Cleared when prism was removed.							
118.	M	29	O	+	2△	4 exo.	10 exo.	6/−2	24/20
		The 2△ base-in prism caused vertigo. When prism was reduced to 1△ base-in the prism was used successfully.							
119.	F	35	−	+	1△	3 exo.	9 exo.	12/4	26/20
		Prism caused headache in this case. Headache relieved when prism was removed.							
120.	M	26	+	+	1△	1 exo.	7 exo.	20/16?	16/10
		In this case the positive fusional reserve finding was very doubtful. The prism was tried subjectively and preferred by the patient.							

cases in which the lateral prism could not be worn. Case 118 seems to have been overcorrected, as this patient was able to wear the reduced amount of prism with comfort. Case 120 illustrates a case in which the usual indications for the need for prisms are almost totally absent except that the recovery for the PFR was very indeterminate and unreliable. Subjectively, prism was emphatically preferred, and as no change was found in the correction prescribed, for his symptoms.

SUMMARY

Of a total of 66 cases in which prism base-in was prescribed,

two thus far have indicated the removal of the prism, and one a change in amount. Of the balance, most seem to be wearing the prism comfortably insofar as the writer knows. Of these 63,

19 showed no significant change in correction.

11 accepted more plus or less minus, and 3 accepted markedly more plus.

1 accepted less plus.

24 entered without corrections, of which: 18 accepted plus, 2 accepted minus, and 4 accepted no correction.

5 entered with minus and left with plus.

Again in at least 23 of the above cases the comfort of the wearer cannot be ascribed to a change in prescription. Also, several of the others, particularly those who revealed pseudo-myopia, depend upon the prisms for the ultimate correction.

LATERAL IMBALANCES—B.

Table VII demonstrates five cases in which prism base-out was prescribed. Cases 121 and 123 are definitely indicated by both phorias

TABLE VII. LATERAL IMBALANCES. Base-out Corrections.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prism Prescribed (Base-out)	Phoria at 6 M.	Phoria at 33 cm.	Duction at 33 cm. (Base-in)	Duction at 33 cm. (Base-out)
121.	M	29	O	+	4△	16 eso.	8 eso.	40/20	8/–8
122.	M	78	–	M–	2△	Prism needed for fusion with correction.			
123.	F	21	O	–	1△	7 eso.	6 eso.	20/0	(S)
124.	M	10	O	+	1△	1 exo.	1 eso.	20/8	10/6
125.	F	16	O	+	1△	2 eso.	6 exo.	22/20	16/8

and ductions. Case No. 122 required prism to secure fusion. All three showed marked increase in acuity with the prism. Cases 124 and 125 do not demonstrate such clear cut indications in the phorias and ductions, but the low findings of case 124, and the distance phoria of 125, led the writer to experiment with subjective acceptance of prism. Both were readily improved in acuity and ease of seeing with the prism. All five show changes in correction.

LATERAL AND VERTICAL IMBALANCES

1. Table VIII includes 10 cases in which both vertical and lateral imbalances were revealed and which required prism in both directions for correction.

TABLE VIII. LATERAL AND VERTICAL IMBALANCES. As Indicated by Phoria and Vertical Duction Findings. These cases were corrected by both lateral and vertical prisms. The vertical prisms are recorded in the table as base-down over either the right or left eye.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Combined Prismatic Correction.	Lateral Phoria at 6 M.	Lateral Phoria at 33 cm.	Hyperphoria at 6 M.	Hyperphoria at 33 cm.	Duction at 33 cm. (Base-in)	Duction at 33 cm. (Base-out)	Right Supra-duction.	Right Infra-duction.
126.	F	46	+	+	1△ − In⊃1△ O.S.	2 exo.	12 exo.	1△LH	1△LH	8/−3	20/16	3/2	4/3
127.	F	44	−	O	2△ − In⊃1△ O.S.	8 exo.	17 exo.	3△LH	1△LH	16/4	36/22	2/1	4/2
128.	M	12	O	+	1△ − Out⊃1△ O.D.	5 eso.	1 eso.	1△RH	2△RH	18/10	10/6	4/2	2/1½
129.	F	31	+	M+	2△ − In⊃1△ O.D.	3 exo.	10 exo.	2△RH	2△RH	12/3	22/14	4/3	2/2½
130.	M	16	O	−	1△ − In⊃1△ O.D.	3 exo.	12 exo.	3△RH	3△RH	10/0	24/18	3/2	2/1
131.	F	54	+	M+	2△ − In⊃1△ O.S.	4 exo.	14 exo.	2△LH	1△LH	16/−4	24/19	3/0	5/2
132.	F	40	−	−	2△ − In⊃1△ O.D.	2 exo.	10 exo.	2△RH	2△RH	3/−9	24/19	4/2	2/1
133.	M	20	O	M+	1△ − In⊃1△ O.D.	3 exo.	6 exo.	1△RH	1△RH	24/9	24/17	3½/2½	3/1½
134.	M	27	−	M+	2△ − In⊃1△ O.S.	6 exo.	20 exo.	2△LH	2△LH	12/−4	24/16	2/1	5/3
135.	M	66	+	M+	3△ − In⊃1△ O.D.	2 exo.	12 exo.	2△RH	2△RH	8/−8	30/19	6/4	1/−2

Nine cases required base-in, 3 with right hyperphoria and 4 with left. 1 case required base-out, with right hyperphoria.

2 cases showed no change in correction.

3 cases accepted more plus.

3 cases entered without correction, of which 2 accepted plus, and 1 took minus.

1 case shifted from minus to plus.

1 case entered wearing minus and took no correction with prism.

2. Table IX reveals 12 cases in which both lateral and vertical corrections were indicated by the findings, but which accepted prism only in one direction. The first seven accepted only lateral prism, six of them taking base-in, and one base-out. The next three accepted only vertical prism, showing right hyperphoria. Of these 10,

5 revealed no significant change in correction.

2 accepted more plus.

2 entered without correction and accepted plus.

1 entered without correction and accepted little but prism.

It will be observed that this group contains a number of cases who reveal contradictory symptoms at far and near, and who may have exhibited artefacts disguising the real conditions in some cases.

The two remaining cases of the twelve are of interest individually. Case 146 is the record of a man who was examined about two and one-half years prior to the time of the record. At that time a severe chronic conjunctivitis was present which did not respond to medical treatment. Visually, the writer's correction was satisfactory. No imbalance was disclosed. The second visit disclosed the imbalances included in the table. The conjunctivitis was still apparent. As can be seen, only vertical prism was accepted. However, the patient was referred for medical examination instead of a new correction being prescribed, and was found to have a prostate gland involvement. Treatment relieved the ocular symptoms, reduced the conjunctivitis and eliminated the vertical and lateral imbalances.

Case 147 also demonstrates an association between systemic disfunction and the sudden appearance of vertical imbalance. This patient wore no prism, but shortly after an attack of flu, revealed the findings listed. She accepted both the lateral and vertical prism, but upon re-examination, one month later, no longer disclosed the vertical discrepancy, although still accepting and preferring the lateral prism.

SUMMARY

Of the 21 cases that revealed both lateral and vertical imbalances, 10 accepted both prisms, eight accepted lateral prism, and three accepted vertical prism.

TABLE IX. LATERAL AND VERTICAL IMBALANCES. Corrected by Either Prism Base-down or Lateral Prism. But Not by Both.

Case Number.	Sex.	Age.	Refractive Findings at Start.	Final Refractive Findings.	Prismatic Correction.	Lateral Phoria at 6 M.	Lateral Phoria at 33 cm.	Hyperphoria at 6 M.	Hyperphoria at 33 cm.	Duction at 33 cm. (Base-in)	Duction at 33 cm. (Base-out)	Right Supra-duction.	Right Infra-duction.
136.	F	32	+	M+	1△−In	2 exo.	11 exo.	1△RH	1△RH	20/16	20/12	....	...
137.	F	38	−	−	2△−In	7 exo.	5 exo.	2△LH	O	(S)	24/10	....	...
138.	F	23	+	+	1△−In	5 exo.	10 exo.	1△RH	1½△RH	15/6	24/14	2/1	4/3
139.	M	38	O	O	2△−In	1 eso.	9 exo.	3△RH	3△RH	20/2	21/18	5/2	2/1
140.	M	44	O	+	2△−In	4 exo.	15 exo.	2△RH	1△RH	15/−12	22/18	5/1	3/−1
141.	M	14	O	+	1△−In	2 exo.	11 exo.	2△RH	2△RH	6/−5	22/12	2/0	2/0
142.	M	37	−	−	2△−Out	1 eso.	1 exo.	1△RH	2△RH	22/4	6/4	1/1	2/1
143.	M	76	+	+	1△ O.D.	0	11 exo.	1½△RH	2△RH	12/−4	22/16	4/2	3/1
144.	M	47	+	M+	1△ O.D.	1 exo.	12 exo.	O	2△RH	16/0	22/20	4/2	3/1
145.	M	27	+	+	1△ O.D.	5 exo.	17 exo.	1△RH	2△RH	12/−2	24/17	4/2	2/1
146.	M	50	+	M+	1△ O.S.	4 eso.	4 exo.	2½△LH	3△LH	12/−1	14/10	0/−2	5/4
147.	F	41	+	+	1△ O.S.	3 exo.	8 exo.	1△LH	1△LH	6/2	6/2	2/−1	3/2

7 showed no change in correction.

5 accepted more plus.

7 entered without correction, of which 4 took plus, 1 took minus, and 2 accepted no correction.

1 entered with minus and took no correction.

1 entered with minus and took plus.

ADDENDA

In considering the cases in which prism base-in was prescribed, a significant test, the near point of convergence, has not been included in the tables, primarily because its indication was uniform in almost all the cases noted. The recession of this point to 6 or more inches from the patient constituted one of the chief "clues" which led the writer to attempt prism, particularly in those cases in which the phorias and ductions were not strongly directive. Also, while no association is indicated, certain subjective complaints have predominated in the cases, and have also served as clues for the possible prescription of prism. These complaints include: location of headaches as occipital or temporal rather than frontal; complaint of print running together or shadowing or overlapping; necessity for re-reading words which have been missed; loss of place while reading; shadows or blurred edges of objects when acuity is good. These complaints applied to both vertical and lateral discrepancies, but cannot be ascribed purely to convergence or fusion problems, being occasionally present in purely refractive cases. However, they have seemed to constitute a lead towards careful investigation of the acceptability of prism.

CONCLUSION

Since no control group was practical, definite conclusions must await statistical verifications. Some 30 cases do exist in which prism was apparently indicated by the symptoms and findings, but was not accepted subjectively.

The writer has heard from approximately 30 per cent of the cases in which prism was prescribed, either directly or by virtue of referred patients, which indicates that the corrections prescribed were satisfactory to the patient. Insofar as can be determined the use of base-in prism instead of base-out orthoptics treatment seems to be practical.

The 46 cases in which no definite refractive change was found, plus the seven in which no ametropia at all was found, constitute almost 40 per cent of the total, and would seem indicative. Also, eight additional cases moved from minus to plus when prism was incorporated.

The discrepancy between the amount of prism used and the extent of phoria or deficiency of the duction is frequently very marked, but

based upon Sheard's[5] reserve and demand ratio, is not so unusual. However, there seems to be no direct relationship between the extent of imbalance and the amount of prism subjectively accepted. The use of lateral prism is a reverse approach to orthoptics procedures. Whereas the orthoptics techniques tend to extend the parallelogram laterally by extending the reserves, the prism shifts the demand slope within the existing parallelogram of comfort.[6]

Insufficient procedure was employed to determine whether the cases who could not wear the prism, or those, not listed, who did not accept it subjectively, were predominantly integrative rather than motor types,[7] and would require orthoptics treatment of the stereoscopic card form for correction.

Finally, caution is urged upon the practitioner who might interpret this summary as indicating the use of prism for every case complaining of occipital headaches or which exhibits little difference in the refractive prescription. Care must be taken that the refraction is accurate, and that the subjective acceptance is consistent and determined without prejudicing the patient. Primarily, also, more than the usual amount of time is required with the patient.

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ABSTRACTS

MEDICAL MANAGEMENT OF SENILE CATARACT. J. M. Levitt. Eye, Ear, Nose and Throat Monthly. 27. 2. 71-72. 1948.

According to the author a normal metabolism is essential for the maintenance of cryst lline lens transparency. This he claims can only be achieved (1) by a well-balanced diet supplemented by vitamins A, B_1, B_2 and C. (2) by attention to all matters of general hygiene and (3) by the elimination of all focal infections.

Patients suffering from lenticular opacities should be refracted frequently and given corrections which keep vision at the best possible level. In the early stages of lens opacaties Levitt suggests that it would be best to refer to the condition as a "cloudiness of the lens" in discussing the condition with the patient. C.C.K.

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OPTOMETRY AND THE AMERICAN WAY OF LIFE

Symptomatic of what we may expect from the new Congress was the recent report presented by Federal Security Administrator Oscar R. Ewing.[1] Mr. Ewing, who heads one of Washington's largest departments and who is a close adviser of President Truman, came out emphatically for a national program of compulsory sickness insurance and at the same time labeled the present health services as inadequate.

Whether or not the advocates of these social reforms can muster sufficient Congressional strength to carry their proposals through Congress remains to be seen. It is evident, however, that an attempt will now be made to socialize health care by these well-intentioned reformers.[2] While none of Mr. Ewing's comments mentioned refractive work it is

1. News Release, American Medical Association, pages 5-6, October 29, 1948.
2. Carel C. Koch. On the Retention of Free Enterprise. Am. J. Optom. and Arch. Am. Acad. Optom., 25.10.505-507, 1948.

clearly evident that given a chance, all health care and all medical education will be placed under federal supervision and that increased deductions, augmented employer contributions, and additional taxes will confront the American people if these plans carry.

Mr. Ewing speaks for a large and vocal group who in their effort to overcome the lack of adequate medical care for a segment of the population have developed an amblyopia to the problems which their remedies would create. With their eyes fixed on the indigent, the families in the lowest income brackets, and citizenry residing in remote places they are proposing to wreck the existing program of health care and substitute a virtually untried experiment in its place.

Instead of concentrating on correcting the admittedly existing inadequacies—which could readily be done with federal support—Mr. Ewing and his fellow bureaucrats would rather experiment with the underlying economic structure of the country. Judging from his published comments,[3] the collective efforts of present-day health workers have resulted in nothing but failure. Until this is changed to federal control of all health matters, the outlook, Mr. Ewing indicates, is gloomy, indeed.

In their attack — these proponents of socialized medicine are deliberately attempting to overthrow the American way of life. They refuse to recognize that in socializing health care that the door is opened to socializing American industry and American agriculture. This Journal through the years has advocated optometry's participation in health programs to assist those who are unable to secure adequate eye care in the usual manner. We will continue our support of worthwhile measures, but we still insist these problems can be met without removing the incentive which comes under a system of free enterprise.

Optometry will be drawn into the maelstrom of these social reforms during the 81st Congress. The inadequacies of present-day health care will be paraded before our legislators. Organizations representing health workers will be on the defensive. Before the storm breaks organized optometry should point out that visual care in these United States is the finest care supplied to any citizenry in all history. In addition, this care is available to virtually all people at moderate fees.

A little more than two years ago, the optometrists of England, Scotland and Wales were confronted with this problem. A socialistic government was proposing an across-the-board program of health care including free refractions and glasses. After some deliberations, British optometrists through their organizations supported socialized medicine and have now experienced several months of actual practice under the

3. Minneapolis Morning Tribune, page 1, second section, November 8, 1948.

first preliminary program. Recent reports are by no means unanimous on the current status of optometrists under the new program, but it is evident from these that both optometrists and the public are being given a major taste of regimentation. It is too early to predict whether this British program of socialized health care will succeed or whether it will fail. In any event, it would seem wise for our optometric organizations and our legislators in Washington to mark time for several years to see the early results of this British experiment before plunging into a similar program.

It must be understood that the results of the November election were by no means a mandate to Congress to socialize American health or to socialize anything else. Several presidential aspirants ran on radical platforms with no success whatsoever and only those who completely disregard trends would interpret the current democratic victory as a license to overthrow the American way of life.

From an optometric viewpoint the question before us resolves itself into three parts: First, can the existing program of visual care be sufficiently expanded through an extension of local welfare work, to adequately meet the visual problems of our citizens, or must the federal government step in and offer a complete program of refractive care and glasses to every individual through tax supported sources? Second, should the undergraduate educational program for optometric students remain as it is or should the supervision be transferred to the federal government? Third, will the public be better served if private initiative is removed?

With the limited experience of several European countries before us and with the arguments of those who advocate socialized health care still fresh from the political battle front, this Journal sees no need at the present time for the abandonment of free enterprise and the incentives which come to all under this way of life. CAREL C. KOCH.

HOLIDAY GREETINGS

The Journal staff is always pleased for more than one reason when the Holiday season arrives. It gives us a chance to say "Thank you," to our readers for the interest shown in the Journal. And, of course, it gives us a chance to wish each and every reader a Merry Christmas and a very Happy New Year! A hope, too, is on our mind this Christmas which we'd like to add to the season's greetings: a hope that nations will somehow find a way to better understand each other and that the "cold" war in which we find ourselves can be kept from becoming a "hot" war. It is the responsibility of each of us to work toward that goal. The Season's best to you all.

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

FULL ACADEMY REPORT IN JANUARY ISSUE

As we go to press, the American Academy of Optometry is once again making history with its annual convention. More than 21 technical papers are being delivered at Winston-Salem, North Carolina, by optometrists and other scientists interested in visual care. These papers will all be published by the *American Journal of Optometry*. Watch for the first of these early in 1949, along with the complete report of the convention proceedings.

BRITISH MAGAZINE CELEBRATES ANNIVERSARY

The staff of one British optometric magazine did a little justified celebrating recently. The 3,000th issue of *The Optician* rolled off the press on October 1—an issue filled with retrospect about events in the British ophthalmic world since the first date of publication, 1891, and quiet pride over the accomplishment of continuous publication for 57 years.

The publication record of this compact little British magazine is even more enviable in light of several periods of hampering shortages. With the single exception of two weeks in February, 1947, when all British weeklies were suspended owing to the fuel crisis, *The Optician* has appeared regularly for 3,000 consecutive weeks.

The only ophthalmic publication not connected with an official optical organization, *The Optician* has consistently over the years attempted to give its readers an impartial picture of the news and views of the profession.

The Journal adds its congratulations to the many already heaped upon Editor William E. Hardy and his capable staff.

CURRENT QUESTIONS ON OUR MIND

If the issue of exemption of professional men from the peacetime draft comes up in the 81st Congress, will optometrists be included along with physicians and dentists? The October 25th issue of *Newsweek* predicts the issue will be revived. Is it time now, perhaps, for interested optometrists to voice an opinion *before* the discussion starts?

Wonder how the public will ever be completely convinced of the authenticity of refractive procedures when book stores carry kits on

how to get and keep good eyesight without glasses? Found several of these kits on sale while browsing in a Minneapolis book store recently. "A tested and proven system for correcting common errors of vision including nearsightedness, farsightedness, astigmatism, and color blindness," read the blurb on the kit cover. It seems that the theories of Bates will live on and on.

BRITISH "VISION"

If you're interested in what the British lay public is reading these days about visual care, get a copy of the British magazine, *Vision*. Similar in size, content and purpose to America's *Visual Digest*, it currently is informing Britons about the limitations and advantages of contact lenses, about better lighting and better visual care. *Vision*, too, is sprinkled with cartoons and unusual facts in the visual field. Much of the current autumn issue deals, of course, with the new British health program, and how to get glasses and a refraction through the health service. *Vision* is available through the Association of Optical Practitioners, 65 Brook Street, London, W1, England, for one shilling (20c) a copy. It's published three times yearly.

MOVIE AVAILABLE FOR LOCAL GATHERINGS

Available for local optometric groups planning a program is an A.O.A. film on office professionalization. This sound-slide film entitled, "It Makes a Difference," dramatizes the importance of professional optometric offices as contrasted with "commercial" window displaying store fronts. Dr. Paul A. Ludeman, Division of Professional Standards, 761 East 75th Street, Chicago, 19, Illinois, is in charge of bookings. When making your reservation, Dr. Ludeman asks that you state the date, time, place, and approximate attendance expected at the meeting.

BANNON MONOGRAPHS ADDED TO LIST

Added to the monographs now available through the Academy office are two written by Dr. Robert E. Bannon of Columbia University. These monographs were published in 1939 and 1941 when Dr. Bannon was on the staff of the Dartmouth Eye Institute, and the extra supply has only recently been made available for sale. Monograph 1A, "Heterophoria and Aniseikonia," 16 pages plus cover, is 25 cents, and Monograph 1B, "On the Technique of Measuring and Correcting Aniseikonia," 24 pages plus cover, is 35 cents. For the list of other monographs currently available refer to the May and October, 1948 issues of this Journal, or write the editor. Address orders to the Secretary, American Academy of Optometry, 1502 Foshay Tower, Minneapolis, Minnesota.

ME TOO —

The most *current* comment of the day? "Merry Christmas," of course, and this department joins with the editor in wishing our readers a very Merry Christmas and peace in the New Year and all the years to come.

Thanks for keeping current with us, and we hope you'll continue to be as interested in "Current Comments" as you have in the past.

ABSTRACTS

DISTORTION OF BINOCULAR SPACE PERCEPTION INDUCED BY SIZE DIFFERENCES INTRODUCED IN FITTING OF SPECTACLES. C. L. Treleaven. The Columbia Optometrist, 21 Nos. 83 and 84 (Sept. and Dec.), 1947.

In this paper, the problem of patients who report tipping of level surfaces following a change in glasses is discussed with quantitative examples. Monocular clues of spatial localization are distinguished from the binocular retinal disparity which results in stereopsis.

The mathematical quantities are minute. For example, a displacement of 1 meter in the vicinity of an object 10 meters away causes a retinal disparity of only 0.012 mm. However, this much disparity is important subjectively for one can usually and quite easily discern a relative difference in an object at 9 m. as compared to one at 10 m.

Disparity in retinal images may be introduced by lenses of unequal magnification—as, for example, in the correction of anisometropia. A 1 per cent difference in relative magnification of either image is a significant quantity as it causes a vertical plane, subtending an angle of 4 degrees at a distance of 10 m., to be tipping about 45 degrees —or so that one end should appear about 1 m. nearer than the other. However, in normal surroundings the full geometric effect of an image disparity is not always noticed because of the influence of monocular clues. Nevertheless those individuals who are sensitive to retinal image disparities have a conflict between monocular visual clues and the binocular distortion of space which is frequently profound and disturbing. Those clinicians experienced in the field of aniseikonia have found a 1 per cent difference in the relative size of the images to be of significant importance in that patients have been relieved of distressing symptoms by a 1 per cent correction.

The three properties of spectacle lenses: (1) power, (2) position, (3) form— are discussed mathematically and illustrative examples given. Two case histories are presented in which the clinical consideration of image disparities proved helpful to the patient. R.E.B.

A PRELIMINARY SURVEY OF THE FINDINGS RELATED TO INTRAOCULAR TENSION WHEN TAKEN WITH THE WOLFE TONOMETER, J. D. Rogers. The Canadian Journal of Optometry, June issue, 170-173, 1948.

The author suggests the routine use of the Wolfe Scleral Tonometer in optometric practice and advises that a number of comparative findings be made at proper intervals on each patient with the same instrument in those cases which fall within the doubtful zone. C.C.K.

REPORT ON AN EYESIGHT SURVEY IN THE WAUKEGAN PUBLIC SCHOOLS, F. V. LeMieux. The Illinois Optometrist, 6, 4, 32-33, 1948.

The author reports the results of a visual skills survey completed in the Waukegan Public Schools. The survey was conducted by eight optometrists. Eighteen per cent of the total student body were found to have visual problems which required further attention. These students were referred to their own specialists for further attention. The number of students tested was 3,306. Two tables. V.H.

VOLUME 25, 1948, GENERAL INDEX

This is an index covering all of the departments of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY. The letters used to explain in which department the material indexed appears are as follows: (OP), Original paper; (E), Editorial; (T), Transactions of the Academy; (CC), Current Comments by Virginia Huck; (SR), Special Reports; (C), Correspondence; (Ab), Abstracts; (BN), Book Notices; and (A), Announcements.

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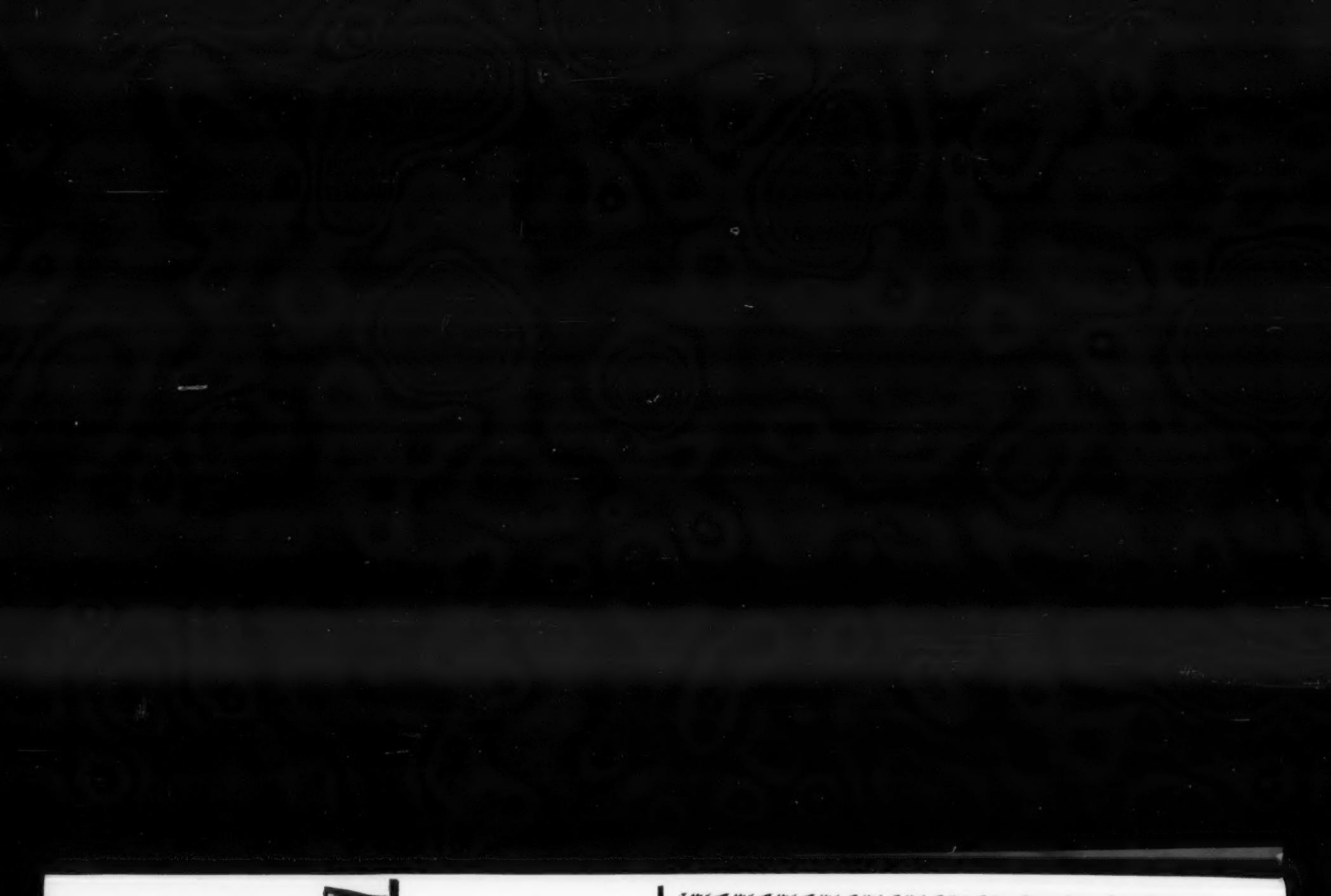

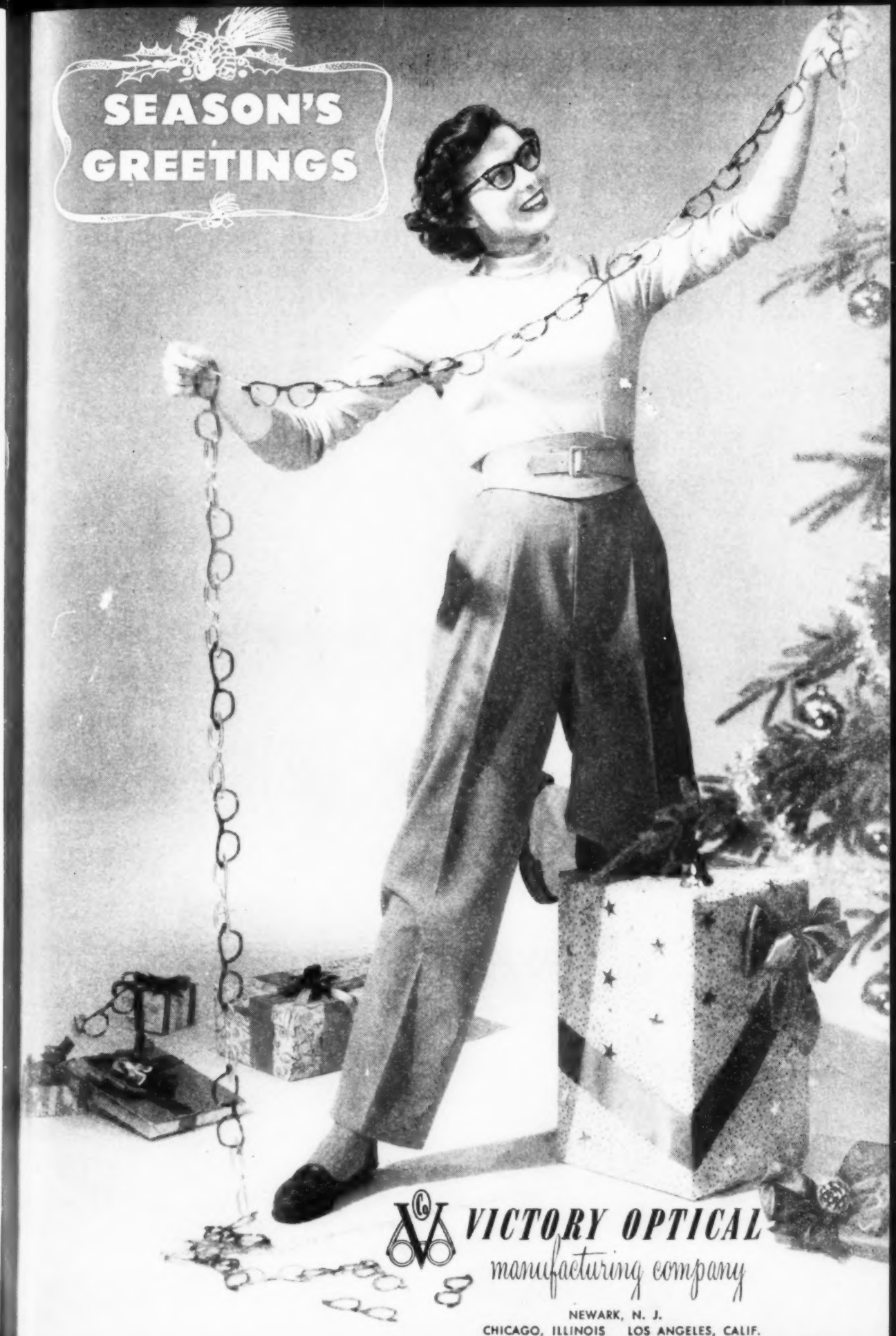
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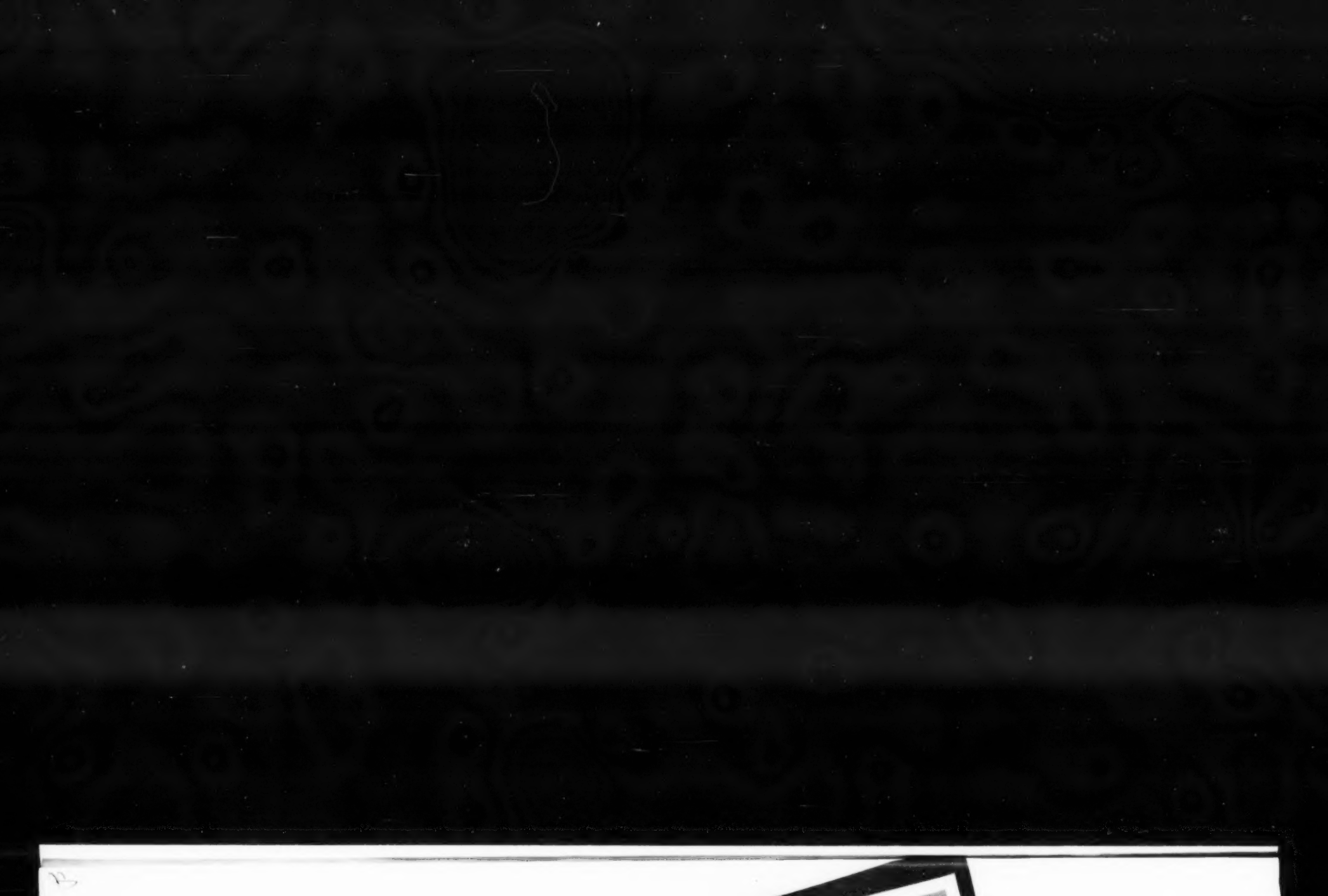
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Season's Greetings
and
the best of Good Wishes to
Each One of You
with sincere appreciation
for your
friendly cooperation
during the past year.
Sharon Optical Company, Inc.